PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing (*day/month/year*)	16 MAR 2007
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
MI22-2102	

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US02/26191	15 August 2002 (15.08.2002)	16 August 2001 (16.08.2001)

Applicant

MICRON TECHNOLOGY

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Rhonda for Bell Carl Whitehead Jr. Telephone No. (571) 272-1702

Form PCT/IPEA/416 (July 1992)

EV953730329

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
MI22-2102		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US02/26191	15 August 2002 (15.08.2002)	16 August 2001 (16.08.2001)

International Patent Classification (IPC) or national classification and IPC

IPC: **H01L 21/44**(2006.01)
USPC: 438/680,681,686

Applicant

MICRON TECHNOLOGY

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets. including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
14 March 2003 (14.03.2003)	28 February 2007 (28.02.2007)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Richard for Carl Whitehead Jr. Telephone No. (571) 272-1702

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US02/26191

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description:
pages 1-6 as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☒ the claims:
pages 7-10, as originally filed
pages NONE, as amended (together with any statement) under Article 19
pages NONE, filed with the demand
pages 7 and 8, filed with the letter of 01 February 2001 (01.02.2001) _____.

☒ the drawings.
pages 1, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

☐ the description, pages NONE

☒ the claims, Nos. 1-23 and 36-50

☐ the drawings, sheets/~~fig~~ NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*
*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 24-35	YES
	Claims None	NO
Inventive Step (IS)	Claims NONE	YES
	Claims 24-35	NO
Industrial Applicability (IA)	Claims 24-35	YES
	Claims NONE	NO

2. CITATIONS AND EXPLANATIONS
Please See Continuation Sheet

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

V. 2. Citations and Explanations:

Claims 24-32 and 34 lacks an inventive step under PCT Article 33(3) as being obvious over Buchanan (U.S. 6,984,591).

Buchanan (e.g. Fig. 2, 30) discloses:

(cl. 24) A method of forming a metal comprising mass for a semiconductor construction, comprising: providing a semiconductor substrate (30) providing one metalo-organic precursor (Fig. 28) proximate the substrate, at least one precursor not comprising platinum (e.g. "Ru"; Abstract), exposing the one or more precursor to a reducing atmosphere (CLAIM 16 of Buchanan) and depositing the released material over the semiconductor substrate to form metal-comprising mass (33) on the semiconductor; wherein the substrate comprises an upper surface consisting of Tan (Col. 6, Lines 45-46) and wherein the upper surface is exposed to the reducing atmosphere during the release of the metal (e.g. metal, 33 formed on Tan); wherein the substrate comprises an oxizable upper surface ("sio.sub. 2", 83; Col. 27, Line 35); wherein TaN is physically against upper surface of substrate (e.g. capacitor recess is formed in substrate, barrier abuts portion of substrate; Fig. 30);

(cont. cl. 24) forming a polysilicon, electrical interconnect (31) in electrical contact with nodes (33,35), the electrical interconnect being silicon (not limited to polysilicon; Col. 27, Lines 40-43), forming a conductive material (32) over the interconnect, the conductive material comprising Tan (Col. 6, Lines 45-46), providing a semiconductor substrate (30) providing one metalo-organic precursor (Fig. 28) proximate the substrate, at least one precursor (e.g. "Ru"; Abstract), exposing the one or more precursor to a reducing atmosphere (CLAIM 16 of Buchanan) and depositing the released material over the semiconductor substrate to form first capacitor electrode (33), forming a dielectric (34) over the first the first electrode, and forming a second capacitor electrode (35) over the dielectric **material utilizing oxidizing conditions ("oxidizing agent"; CLAIM 16 of Buchanan);**

(cl. 25) the precursor consists essentially of ruthenium (Abstract);
(cl. 26) the precursor consists essentially of rhodium (Abstract);
(cl. 27) the precursor consists essentially of iridium (Abstract);
(cl. 28) the precursor consists essentially of cobalt (Abstract);
(cl. 29) the precursor consists essentially of palladium (Abstract);
(cl. 30) the precursor consists essentially of platinum (Abstract);
(cl. 31) the precursor consists essentially of Nickel (Abstract);
(cl. 34) the reducing atmosphere comprises hydrogen (CLAIM 17 of Buchanan);

With respect to claims 24 and 32 the selection of material for their known intended use does not impart, since doping silicon was a known as a way of making a silicon material more conductive. As such, there is no inventive step for choosing doped silicon, where Buchanan already discloses that his interconnect is a form of silicon, and that it may be other materials. Similarly, the selection of Tricarbonylcylcohexadiene ruthenium as a precursor material does not impart an inventive step where Buchanan discloses use of a ~~ruthenium, since Tricarbonylcylcohexadiene ruthenium is encompassed with a disclosure of using ruthenium. The claimed material is~~

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

contemplated by the Buchanan.

Claims 33 and 35 lacks an inventive step under PCT Article 33(3) as being obvious over Buchanan (U.S. 6.984, 591). in view of Baum (U.S. 6,690,055).

Buchanan discloses the elements above, but fails to explicitly disclose that its hydrogen is specifically H.sub. 2 or that the reducing agent is NH.sub. 3.

However discloses the same invention except that it des disclose that its Hydrogen is H.sub. 2 or use of NH.sub. 3 as a reducing agent, Baum shows that H.sub. 2 and NH.sub. 3 are art known reducing agents used to produce equivalent structures. Therefore, because these H.sub.2 and NH.sub. 3 are art recognized equivalents at the time the invention was made; one would not find it an inventive step to substitute NH.sub.3 for H.sub.2. Similarly it would not have been an inventive step to form the Hydrogen of Buchanan as H.sub. 2 since H.sub.2 is a known hydrogen form used as reducing agents.

---------- NEW CITATIONS ----------
US 6,984,591 (Buchanan et al) 10 January 2006, see Abstract

CLAIMS

1-23 (cancelled).

24. A method of forming a capacitor, comprising:

providing a semiconductor substrate having an electrical node supported thereby;

forming an electrical interconnect in electrical contact with the node, the electrical interconnect comprising conductively-doped silicon;

forming a conductive material over the electrical interconnect, the conductive material comprising one or more of TiN, WN, TaN, elemental Ta, elemental Ti and elemental W;

providing a metallo-organic precursor proximate the conductive material, the metallo-organic precursor comprising one or more of ruthenium, rhodium, iridium, cobalt, palladium, platinum and nickel;

exposing the precursor to a reducing atmosphere to release metal from the precursor, the released metal consisting essentially of one or more of ruthenium, rhodium, iridium, cobalt, palladium, platinum and nickel;

depositing the released metal over the conductive material to form a first capacitor electrode;

forming a dielectric material over the first capacitor electrode; and

forming a second capacitor electrode over the dielectric material; wherein the second capacitor electrode comprises metal; and wherein the forming the second capacitor electrode comprises exposing a metal-comprising precursor to an oxidizing atmosphere; and

wherein the oxidizing atmosphere improves dielectric properties of the dielectric material.

25. The method of claim 24 wherein the precursor comprises ruthenium, and wherein the released metal consists essentially of ruthenium.

26. The method of claim 24 wherein the precursor comprises rhodium, and wherein the released metal consists essentially of rhodium.

27. The method of claim 24 wherein the precursor comprises iridium, and wherein the released metal consists essentially of iridium.

28. The method of claim 24 wherein the precursor comprises cobalt, and wherein the released metal consists essentially of cobalt.

29. The method of claim 24 wherein the precursor comprises palladium, and wherein the released metal consists essentially of palladium.

30. The method of claim 24 wherein the precursor comprises platinum, and wherein the released metal consists essentially of platinum.

31. The method of claim 24 wherein the precursor comprises nickel, and wherein the released metal consists essentially of nickel.

32. The method of claim 24 wherein the precursor comprises tricarbonyl-cyclohexadiene ruthenium.

33. The method of claim 24 wherein the reducing atmosphere comprises NH_3.

34. The method of claim 24 wherein the reducing atmosphere comprises plasma activated hydrogen.

35. The method of claim 24 wherein the reducing atmosphere comprises H_2.

36-50 (cancelled).